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पिटवां इस्पातों में अधात्वीय अन्तर्वेशन अंश ज्ञात करने की स्थूलदर्शी पद्धति

भाग 1 नील भंग परीक्षण पद्धति

(पहला पुनरीक्षण)

Indian Standard

MACROSCOPIC METHODS FOR DETERMINATION OF NON-METALLIC INCLUSION CONTENT IN WROUGHT STEELS

PART 1 BLUE FRACTURE TEST METHOD

(First Revision)

UDC 669·141·22 : 620·192·45 : 620·184

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

January 1992 **Price Group 2**

Metallography and Heat Treatment Sectional Committee, MTD 22

FOREWORD

The Indian Standard (*First Revision*) was adopted by the Bureau of Indian Standards, after the draft finalized by the Metallography and Heat Treatment Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This method consists of determining the total number and distribution of inclusions visible on the surface of the fracture which has undergone blue tempering. This fracture is in the longitudinal direction of the product and its inclusions normally appear as white stringers. The blue fracture test method is applicable to forged, extruded, drawn or rolled products and may be used for a wide range of products. In general, the test is carried out on semi-finished products. This method deals with determination of non-metallic inclusions visible to the naked eye or with the aid of a magnifying glass with magnification of not more than × 10.

This standard consists of three parts. The other parts are:

Part 2 Step machined test method,
Part 3 Magnetic particle inspection method.

In this standard only those inclusions which are equal to or greater than 1·5 mm in length and 0·1 mm thick are taken into consideration. The parameters characterising the non-metallic inclusions shall be their total number and their length and/or thickness. No distinction is made in this standard concerning the type of inclusions.

In the preparation of this standard, assistance has been derived from the following publications:

a) ISO 3763 : 1976, 'Wrought steels — Macroscopic method for assessing the content of non-metallic inclusions' issued by the International Organization for Standardization (ISO)
b) SIS 111110, 'Methods for assessing the slag inclusions content in steels—Macroscopic methods' issued by Swedish Standards Institution (SSI)
c) SEP 1584, 'Blue fraction test for examination of macroscopic non-metallic inclusions' issued by

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960, 'Rules for rounding off numerical values (*revised*)'.

Indian Standard

MACROSCOPIC METHODS FOR DETERMINATION OF NON-METALLIC INCLUSION CONTENT IN WROUGHT STEELS

PART 1 BLUE FRACTURE TEST METHOD

(First Revision)

1 SCOPE

This standard (Part 1) prescribes the method for carrying out the blue fracture test for determining the macroscopic streaks of non-metallic inclusions in wrought steels.

2 TERMINOLOGY

2.0 For the purpose of this standard, the following definition shall apply.

2.1 Blue Fracture

The surface of a fracture which has been heated to the blue brittleness tempering range to produce a blue colour on the entire cross-section of the specimen.

3 SAMPLING

Number of samples to be taken for testing for a particular cast lot shall be subject to agreement between the supplier and the purchaser. In general five samples from each cast/lot shall be considered sufficient to assess the quality of steel.

4 TEST PIECE

4.1 The test piece shall consist of a slice, the thickness (for example, between 10 and 20 mm) of which depends on the dimensions of the product, the slice thickness being measured parallel to the longitudinal direction, and the slice being taken by hot or cold sawing or by flame cutting. The thickness shall be such that the slice can be easily fractured after cutting a notch. The thickness of the slice below the notch is recommended as 10-15 mm, the report should clearly mention the sample size, that is, Fractured area.

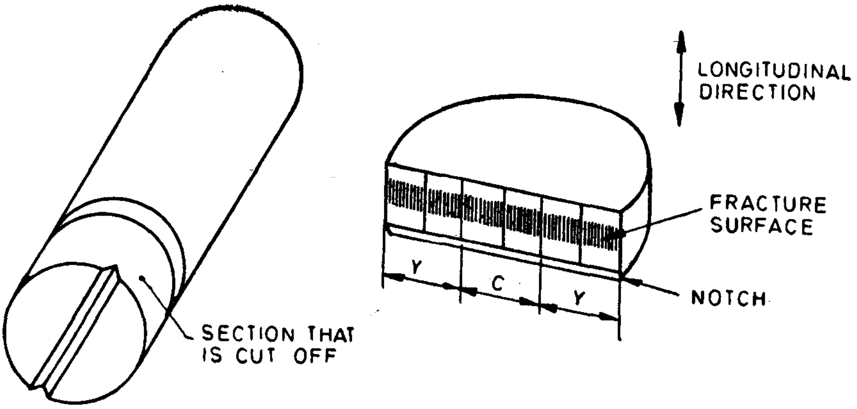
4.2 When flame cutting is used, bars shall be taken to ensure that the fracture takes place outside the heat-affected zone.

4.3 The number and position of the test pieces shall be subject to agreement between the purchaser and the manufacturer. For samples of smaller cross-section (up to about 100 mm^2 square/round) a single notch transverse to the direction of rolling shall be cut as shown in Fig. 1A. In case the cross-section of material is large (above 100 mm^2) test piece selection may be done as given in Fig. 1B or 1C for square/rectangular and round product respectively.

4.4 Two notches perpendicular to each other shall be cut on the test piece as shown in Fig. 1B or 1C and the fractured surfaces examined in two directions. The depth of the notch shall be not more than 1/3 of sample thickness. The notch shall be sufficiently sharp so that the sample can be fractured without much plastic deformation.

5 TEST PROCEDURE

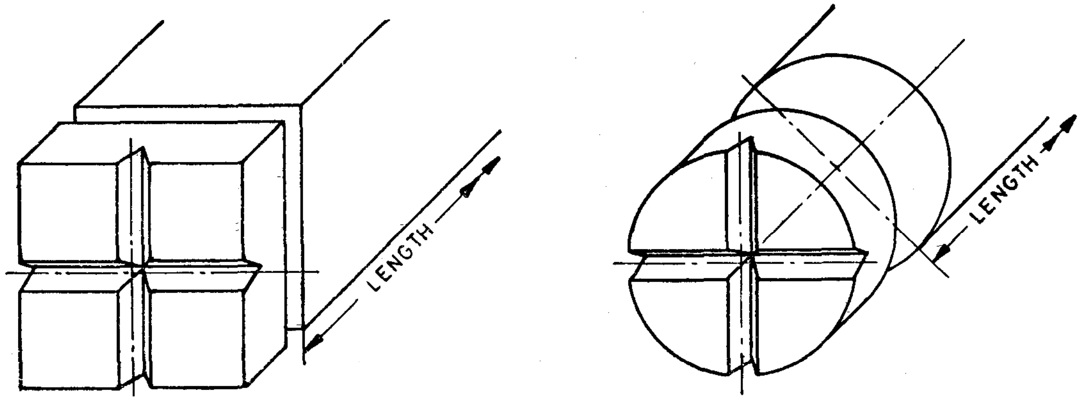
5.1 After undergoing normalizing treatment if necessary, the test piece shall be either heated in air so that at the moment of starting the test,



Y = Outer zone
C = Centre zone

1A CROSS-SECTION (UP TO ABOUT 100 mm^2) OF SQUARE/ROUND WITH A SINGLE NOTCH

FIG. 1 TEST PIECES NOTCHES —*Continued*



1B CROSS-SECTION (ABOVE 100 mm²) OF SQUARE/RECTANGULAR WITH TWO NOTCHES

1C CROSS-SECTION (ABOVE 100 mm²) OF ROUND WITH TWO NOTCHES

FIG. 1 TEST PIECES WITH NOTCHES

the metal is at the blue brittleness temperature (300 to 400 °C) or fractured at the ambient temperature and the two pieces subsequently heated to obtain the blue colour on the fractured surfaces.

5.2 In certain cases, which may be subject to agreement between the parties concerned, the test piece may be hardened, followed by tempering.

5.3 The fracture produced on one of the two broken parts of the test piece shall be examined with the naked eye or with the help of a magnifying glass with a magnification less than or equal to × 10.

5.4 In case of difficulty in fracturing a specimen, prior quenching treatment may be given.

6 METHODS OF ESTIMATION

6.1 The examination may be carried out qualitatively or by special agreement between the parties concerned, quantitatively.

6.2 Qualitative Examination

Qualitative examination shall be carried out by comparison with the series of ten reference diagrams included in Fig. 2. When interpreting in conjunction with Fig. 2, account shall be taken of the positions of the inclusions within the section, separately for outer (*Y*) and centre zone (*C*) and the results may be presented in a table as given below:

Sample No.	*The worst rating of each sample as per Fig. 2*	
	Outer Zone (*Y*)	Centre Zone (*C*) as defined in Fig. 1a
1	0	2
2	1	3
3	2	0
4	3	1
5	4	3

6.3 Quantitative Examination

Quantitative examination shall be carried out by counting inclusions and using one (or both) of the following parameters of the inclusions:

i) length, and
ii) thickness

The distribution of the inclusions according to the parameter(s) chosen shall be established according to Tables 1 and 2.

Table 1 Inclusion Distribution Based on Length
(*Clause* 6.3)

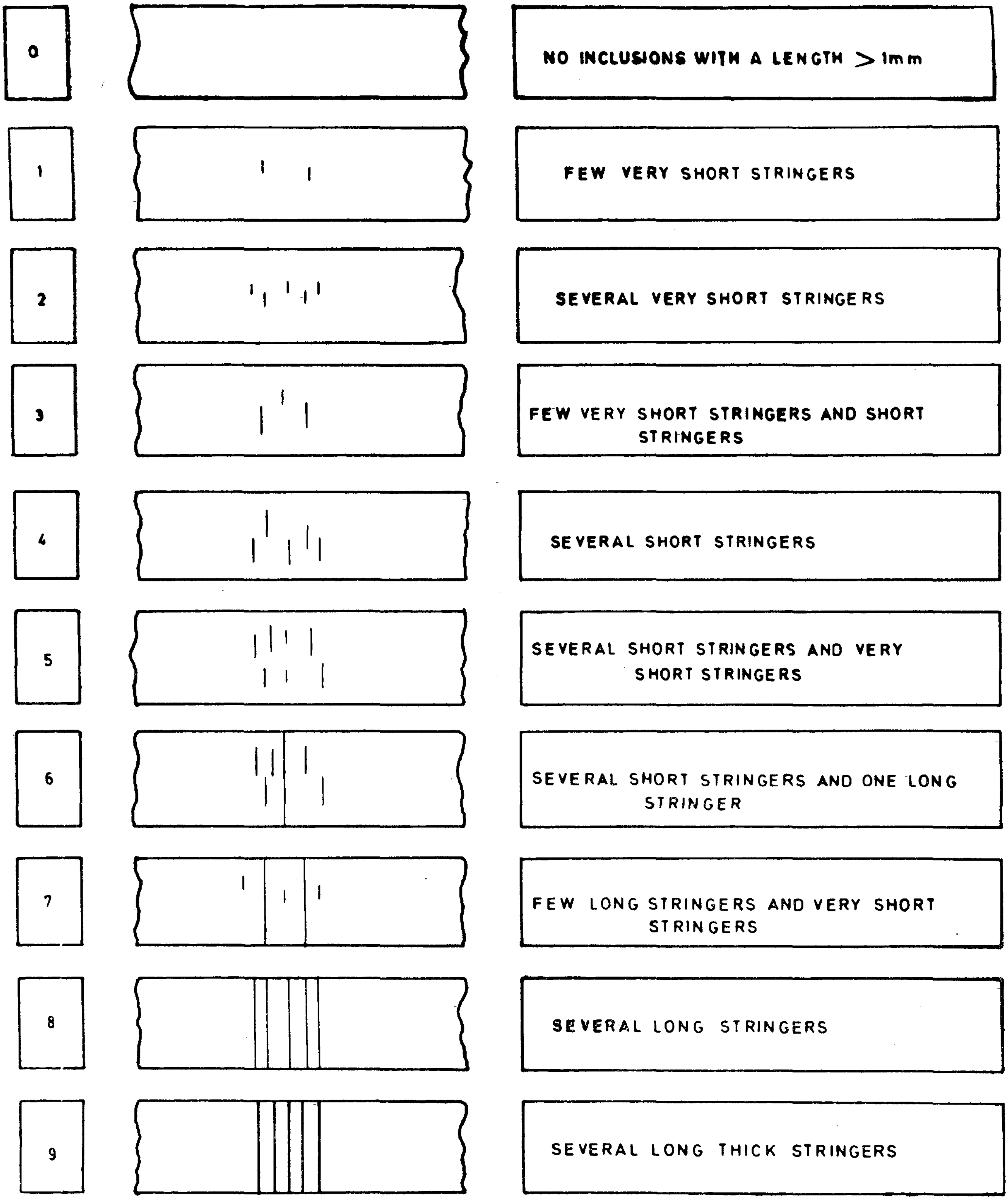
Symbol Lo	Length L, mm no macroscopic inclusion
L1	$1{\cdot}5 \leqslant l \leqslant 2{\cdot}5$
L2	$2{\cdot}5 < l \leqslant 5{\cdot}0$
L3	$5{\cdot}0 < l \leqslant 10{\cdot}0$
L4	$10{\cdot}0 < l$

Table 2 Inclusion Distribution Based on Thickness
(*Clause* 6.3)

Symbol To	Thickness T, mm no macroscopic inclusion
T1	$0{\cdot}1 \leqslant T \leqslant 0{\cdot}25$
T2	$0{\cdot}25 < T \leqslant 0{\cdot}50$
T3	$0{\cdot}50 < T \leqslant 1{\cdot}00$
T4	$1{\cdot}0 < T$

6.4 The acceptance limits shall be the subject of mutual agreement between the purchaser and the manufacturer.

6.5 Comparative tests shall be carried out on the products which have undergone similar manufacturing process and similar size reduction by hot working.


0
NO INCLUSIONS WITH A LENGTH > 1mm
1
FEW VERY SHORT STRINGERS
2
SEVERAL VERY SHORT STRINGERS
3
FEW VERY SHORT STRINGERS AND SHORT STRINGERS
4
SEVERAL SHORT STRINGERS
5
SEVERAL SHORT STRINGERS AND VERY SHORT STRINGERS
6
SEVERAL SHORT STRINGERS AND ONE LONG STRINGER
7
FEW LONG STRINGERS AND VERY SHORT STRINGERS
8
SEVERAL LONG STRINGERS
9
SEVERAL LONG THICK STRINGERS

Explanation of terms

Very short stringers : 1 to 2·5 mm
Short stringers : > 2·5 mm, ≤ 5 mm
Long stringers : > 5 mm

Few : ≤ 3
Several : > 3
Thick : > 0·5 mm

FIG. 2 STANDARD DIAGRAMS FOR THE BLUE FRACTURE TEST METHOD

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